

CLAIMS:

- ✓ 1. An implantable brain stimulation lead comprising:
a lead body having a proximal end, a distal end, and an electrode; and
an electrically insulating member that extends over the lead body and defines a window
that exposes a portion of the electrode to increase directionality of stimulation current
delivered by the electrode.
- ✓ 2. The lead of claim 1, wherein the electrode is substantially ring-like and extends
approximately 360 degrees about the lead body.
3. The lead of claim 2, wherein the portion of the electrode exposed by the window
extends between approximately 110 and 130 degrees about the lead body.
4. The lead of claim 2, wherein the portion of the electrode exposed by the window
extends approximately 120 degrees about the lead body.
- ✓ 5. The lead of claim 1, wherein the lead body has a plurality of electrodes, and the
insulating member defines a plurality of windows, each of the windows exposing a portion
of one of the electrodes.
- ✓ 6. The lead of claim 5, wherein the lead body includes four electrodes, and the
insulating member defines four windows.
- ✓ 7. The lead of claim 5, wherein at least some of the windows are defined at different
axial positions along the lead body.
- ✓ 8. The lead of claim 5, wherein the lead body is substantially cylindrical, and at least
some of the windows are defined at different circumferential positions about the lead
body.
9. The lead of claim 1, wherein the lead body has a plurality of electrodes, and the
window is pitched to extend in a spiral pattern along the length and about the

circumference of the insulating member and thereby expose portions of each of the electrodes.

- ✓ 10. The lead of claim 1, wherein the insulating member is formed as a sleeve-like member that extends over a portion of the lead body.
- ✓ 11. The lead of claim 10, wherein the sleeve-like member is molded to define the window.
- ✓ 12. The lead of claim 10, wherein the sleeve-like member is cut to define the window.
- ✓ 13. The lead of claim 1, wherein the insulating member is coated onto the lead body to define the window.
- ✓ 14. The lead of claim 1, wherein the window has a shape selected from the group consisting of a rectangle, square, oval and circle.
15. The lead of claim 1, wherein the lead body has a diameter of approximately 1.1 to 1.5 mm and the electrode has a length extending longitudinally relative to the lead body of approximately 1.3 to 1.7 mm.
16. The lead of claim 1, wherein the lead body has a diameter of approximately 1.3 mm and the electrode has a length extending longitudinally relative to the lead body of approximately 1.5 mm.
- ✓ 17. An implantable brain stimulation lead comprising:
a lead body having a proximal end, a distal end, and an electrode; and
means for insulating at least a portion of the lead body and exposing a portion of the electrode to increase directionality of stimulation current delivered by the electrode.

5

✓ 20. The lead of claim 17, wherein the lead body has a plurality of electrodes, and the insulating means exposes a portion of each of the electrodes.

10

23. The lead of claim 17, wherein the lead body has a plurality of electrodes, and the insulating means defines a window that is pitched to extend in a spiral pattern along the length and about the circumference of the insulating member and thereby expose portions of each of the electrodes.

25

30

26. A implantable lead kit for brain stimulation, the lead kit comprising:
a lead body having a proximal end, a distal end, and an electrode; and

an electrically insulating member defining a window; and means for attaching the insulating member to the lead body such that the insulating member extends over the lead body and the window exposes a portion of the electrode to thereby increase directionality of stimulating current delivered by the electrode.

5

- ✓ 27. The lead kit of claim 26, wherein the electrode is substantially ring-like and extends approximately 360 degrees about the lead body.

10

28. The lead kit of claim 27, wherein the portion of the electrode exposed by the window extends between approximately 110 and 130 degrees about the lead body.

29. The lead kit of claim 27, wherein the portion of the electrode exposed by the window extends approximately 120 degrees about the lead body.

- ✓ 30. The lead kit of claim 26, wherein the lead body has a plurality of electrodes, and the insulating member defines a plurality of windows, each of the windows exposing a portion of one of the electrodes.

- ✓ 31. The lead kit of claim 30, wherein the lead body includes four electrodes, and the insulating member defines four windows.

- ✓ 32. The lead kit of claim 30, wherein at least some of the windows are defined at different axial positions along the lead body.

25

- ✓ 33. The lead kit of claim 30, wherein the lead body is substantially cylindrical, and at least some of the windows are defined at different circumferential positions about the lead body.

30

34. The lead kit of claim 30, wherein the lead body has a plurality of electrodes, and the window is pitched to extend in a spiral pattern along the length and about the circumference of the insulating member and thereby expose portions of each of the electrodes.

35. The lead kit of claim 30, further comprising a plurality of the insulating members, wherein the insulating members include differently configured windows to selectively expose a portion of the electrode.

5

36. The lead of claim 26, wherein the lead body has a diameter of approximately 1.1 to 1.5 mm and the electrode has a length extending longitudinally relative to the lead body of approximately 1.3 to 1.7 mm.

10

37. The lead of claim 26, wherein the lead body has a diameter of approximately 1.3 mm and the electrode has a length extending longitudinally relative to the lead body of approximately 1.5 mm.

✓ 38. A method for producing directional output from an implantable stimulation lead having a lead body and an electrode formed with the lead body, the method comprising: forming an insulating member over the lead body, wherein the insulating member defines a window; and positioning the insulating member relative to the lead body so that the window exposes a selected portion of the electrode to increase directionality of stimulating current delivered by the stimulation electrode.

39. The method of claim 38, wherein the electrode is substantially ring-like and extends approximately 360 degrees about the lead body, and the portion of the electrode exposed by the window extends for approximately 110 to 130 degrees about the lead body.

25

40. The method of claim 39, wherein the portion of the electrode exposed by the window extends approximately 120 degrees about the lead body.

30

✓ 41. The method of claim 38, wherein the lead body has a plurality of electrodes, and the insulating member defines a plurality of windows, the method further comprising positioning the insulating member so that each of the windows exposes a portion of one of the electrodes.

- 5 ✓ 42. The method of claim 41, wherein the lead body includes four electrodes, and the insulating member defines four windows, the method further comprising positioning the insulating member so that each of the four windows exposes a portion of one of the four electrodes.
- ✓ 43. The method of claim 41, wherein at least some of the windows are defined at different axial positions along the lead body.
- 10 ✓ 44. The method of claim 41, wherein the lead body is substantially cylindrical, and at least some of the windows are defined at different circumferential positions about the lead body.
- ✓ 45. The method of claim 44, wherein the lead body has a plurality of electrodes, and the window is pitched to extend in a spiral pattern along the length and about the circumference of the insulating member and thereby expose portions of each of the electrodes, the method further comprising positioning the insulating member so that selected portions of the electrodes are exposed at selected portions of the window..
- ✓ 46. The method of claim 38, wherein the insulating member is formed as a sleeve-like member that extends over a portion of the lead body, and positioning the insulating member includes sliding the insulating member relative to the lead body..
- 25 47. The method of claim 46, wherein the sleeve-like member is molded to define the window.
48. The method of claim 46, wherein the sleeve-like member is cut to define the window.
- 30 49. The method of claim 38, wherein the insulating member is coated onto the lead body to define the window, and positioning the insulating member includes controlling the

1000379 12004
15
20
25
30

coating of the insulating member to define the position of the window relative to the electrode.

- 5 ✓ 50. The method of claim 38, wherein the window has a shape selected from the group consisting of a rectangle, square, oval and circle.

51. The method of claim 38, wherein the lead body has a diameter of approximately 1.1 to 1.5 mm and the electrode has a length extending longitudinally relative to the lead body of approximately 1.3 to 1.7 mm.

10 52. The method of claim 38, wherein the lead body has a diameter of approximately 1.3 mm and the electrode has a length extending longitudinally relative to the lead body of approximately 1.5 mm.

- ✓ 53. The method of claim 31, further comprising defining axial and radial positions of the lead body relative to a desired stimulation target.

- ✓ 54. An implantable brain stimulation lead comprising:
a lead body having a proximal end, a distal end, and an electrode;
an electrically insulating member that extends over the lead body and defines a window that exposes a portion of the electrode to increase directionality of stimulation current delivered by the electrode; and
a mechanism that substantially fixes the insulating member in place relative to the lead body.

- 25 ✓ 55. The lead of claim 54, wherein the mechanism includes an interlocking structure that joins the insulating member and the lead body.

- 30 ✓ 56. The lead of claim 55, wherein the interlocking structure includes an aperture formed in the insulating member and a locking member carried by the lead body, the locking member being insertable into the aperture to substantially fix the insulating member in place relative to the lead body.

- ✓ 57. An implantable brain stimulation lead comprising:
- a lead body having a proximal end and a distal end;
 - a distal electrode adjacent the distal end of the lead body;
 - an intermediate electrode disposed between the proximal and distal ends of the lead body;
 - a first electrically insulating member that extends over the lead body proximate the distal end and defines a first window that exposes a portion of the distal electrode to increase directionality of stimulation current delivered by the distal electrode; and
 - a second electrically insulating member that extends over the lead body between the proximal end and the distal end and defines a second window that exposes a portion of the intermediate electrode to increase directionality of stimulation current delivered by the intermediate electrode.
- ✓ 58. The lead of claim 57, wherein the intermediate electrode is positioned for access to a first brain target and the distal electrode is positioned for access to a brain second target.
- ✓ 59. The lead of claim 57, wherein the distal electrode includes a plurality of distal electrodes.
- ✓ 60. A brain stimulation system comprising:
- a lead body having a proximal end and a distal end;
 - an electrode on the lead body;
 - an electrically insulating member that extends over the lead body and defines a window that exposes a portion of the electrode to increase directionality of stimulation current delivered by the electrode;
 - a conductor extending between the electrode and the proximal end of the lead body; and
 - a stimulation controller that delivers stimulation current to the electrode via the conductor.
- ✓ 61. The system of claim 60, wherein the electrode is substantially ring-like and extends approximately 360 degrees about the lead body.

62. The system of claim 61, wherein the portion of the electrode exposed by the window extends between approximately 110 and 130 degrees about the lead body.

63. The system of claim 62, wherein the portion of the electrode exposed by the window extends approximately 120 degrees about the lead body.

✓ 64. The system of claim 61, wherein the lead body has a plurality of electrodes, and the insulating member defines a plurality of windows, each of the windows exposing a portion of one of the electrodes.

✓ 65. The system of claim 64, wherein at least some of the windows are defined at different axial positions along the lead body.

✓ 66. The system of claim 64, wherein the lead body is substantially cylindrical, and at least some of the windows are defined at different circumferential positions about the lead body.

67. The system of claim 60, wherein the lead body has a plurality of electrodes, and the window is pitched to extend in a spiral pattern along the length and about the circumference of the insulating member and thereby expose portions of each of the electrodes.

✓ 68. The system of claim 60, wherein the insulating member is molded to define the window.

✓ 69. The system of claim 60, wherein the insulating member is cut to define the window.

70. The system of claim 60, wherein the lead body has a diameter of approximately 1.1 to 1.5 mm and the electrode has a length extending longitudinally relative to the lead body of approximately 1.3 to 1.7 mm.

71. The system of claim 60, wherein the lead body has a diameter of approximately 1.3 mm and the electrode has a length extending longitudinally relative to the lead body of approximately 1.5 mm.

5

- ✓ 72. An implantable brain stimulation lead comprising:
a lead body having a proximal end, a distal end, and an electrode; and
an electrically insulating member that extends over the lead body and defines a window that exposes a portion of the electrode to increase directionality of electrical activity sensed by the electrode.

10

100927-1904
705027-228001